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IHR ZEICHEN: 23495

PA DR. F. GIBLER
EINGELANGT
24. NOV. 1999
FRIST: 24.1.2000

1. Vorbescheid

Auf Grund des Ergebnisses der gemäß § 99 des Patentgesetzes vorgenommenen Vorprüfung werden Sie eingeladen, falls die Anmeldung weiterverfolgt werden sollte, binnen z w e i M o n a t e n nach Zustellung des Vorbescheides sich hierüber zu äußern und

- ☐ die Einheitlichkeit der Anmeldung herzustellen (§ 88 PatG)
- ☒ die angeführten Mängel der Anmeldung zu beheben
- ☐ die in der Beilage angemerkten Korrekturen entsprechend durchzuführen
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  - ☐ eine Beschreibungsergänzung/neue Beschreibungsseite(n)
  - ☒ eine neue Beschreibungseinleitung/angepasste Beschreibung
  - ☐ ein (neues) Deckblatt (Vordruck PA 3 l)
  - ☐ eine (neue) Zusammenfassung

- ☐ die vorschriftsmäßigen Zeichnungen vorzulegen
- ☒ die Erfindungseigenschaft im Hinblick auf den nachgewiesenen Stand der Technik ausführlich zu begründen
- ☐ im Hinblick auf die Intervalliteratur das Prioritätsrecht nachzuweisen (§ 95 Abs. 3 PatG)

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Der Antrag auf Verlängerung der Frist ist stempelpflichtig.

Angeschlossen sind: Beschreibung PAZ 03751, Patentansprüche PAZ ,

Beschreibung PAZ , Patentansprüche PAZ ,

Blatt Zeichnungen PAZ ,

Zusammenfassung PAZ , zur Benützung und Wiedervorlage

☐ Vordruck PA 3 l zweifach ☐ Vordruck PA 3h ☐ Anwaltsverzeichnis

Ergebnis der Vorprüfung umseitig !

Österreichisches Patentamt
Technische Abteilung III
Wien, am 4. November 1999
i. V. Dipl.-Ing. Hajos

Der in der Beschreibung auf Seite 2 (Seite 1 des Beschreibungstextes), dritter Absatz, erläuterte funktionswesentliche Umstand ist aus dem Wortlaut des derzeitigen Anspruches 1 nicht ganz klar ersichtlich. Der letzte Abschnitt des Anspruches 1 wäre daher entsprechend dem nachstehenden Vorschlag zu ergänzen:

„..... mit der Übertragungsleitung (1 , 2) verbundenen Übertragungsvorrichtung (24) gesteuert ist, wobei bei Feststellung eines niedrigeren Leistungsbedarfs des Ortsteils (2) eine niedrigere Fernspeisespannung und bei Feststellung eines höheren Leistungsbedarfs eine höhere Fernspeisespannung an die Übertragungsleitung geschaltet ist."

Weiters wären in den Patentansprüchen noch kleinere Korrekturen entsprechend den Bleistifthinweisen durchzuführen.

Ferner ist auf die WO 95/28793 A1 (British Telecommunications; 18 Seiten) zu verweisen, in der eine Schaltungsanordnung für Fernspeisung von fernmeldetechnischen Einrichtungen über die Übertragungsleitung beschrieben ist, wobei bei niedrigerem Leistungsbedarf eine niedrigere Leistung und bei höherem Leistungsbedarf eine höhere Leistung vom Amt an die Fernmeldeeinrichtung übertragen wird. Siehe insb.die Zusammenfassung sowie Seite 1, Zeile 3 bis Seite 2, Zeile 24 und den Anspruch 1 im Dokument.

Die Erfindungseigenschaft im Hinblick auf diesen bekannten Stand der Technik wäre zu begründen. Ferner wäre die Beschreibung anzupassen.

Im Hinblick auf die im Deckblatt der Beschreibung enthaltene Angabe des Herrn Kovalik als Erfinder wäre eine vorschriftsmäßige Erfindernennung einzureichen.

Nach Vorlage von im obigen Sinne überarbeiteten Unterlagen könnte mit der Fassung des Bekanntmachungsbeschlusses gerechnet werden.

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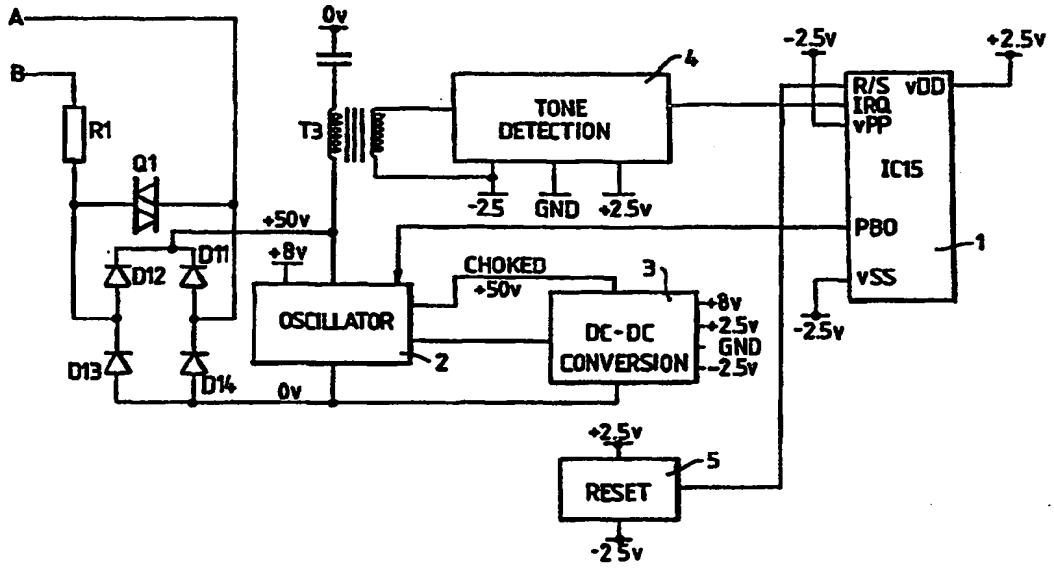
(54) Title: POWER MANAGEMENT FOR LINE POWERED TELECOMMUNICATION APPARATUS



(57) Abstract

Where apparatus connected to a communications line is powered directly from that line it is essential that the current drawn is minimised. The present invention provides a variable power supply comprising a dc to dc conversion circuit (3) controlled by an oscillator (2). The output of the dc to dc conversion circuit (3) is used to power tone detection circuit (4) which monitors for a wake-up tone. On receipt of an appropriate wake-up tone the tone detection circuit (4) provides an interrupt signal to a microprocessor (1) which causes an increase in the oscillator frequency. The increased frequency oscillator (2) increases the power drawn from line via the dc to dc conversion circuit.

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POWER MANAGEMENT FOR LINE POWERED TELECOMMUNICATION APPARATUS

The present invention relates to apparatus for connection to a communications line and more particularly, but not exclusively, to power supply circuits for use with line powered telecommunications apparatus. The invention also relates to interrupt monitoring circuits included in such apparatus.

Telephones, particularly those with features such as amplification, are known to draw line current for powering from the telephone line. These circuits are only active when a telephone is in the "off-hook" condition and do not usually draw current when not in use.

Apparatus, such as facsimile transmission and receiving apparatus or telephone answering machines, which include monitoring circuits normally require relatively high power and include battery or mains electricity power supply sources.

As may be appreciated the 'A' and 'B' wires of a telephone line in the quiescent state have a voltage difference of approximately fifty volts d.c. in United Kingdom telephone exchanges. This voltage is provided so that a telephone line circuit in the exchange can detect looping of the line by a customer instrument by virtue of the current drawn. Such detection will occur if, say, a current of twenty milliamps or greater is drawn, but some circuits, particularly for longer lines, may be made more sensitive.

Thus if a telephone company wishes to provide line-powered apparatus, for example for telemetry applications, the current drawn from the telephone line must be less than the loop detection at lower current limit. Further, since energy consumption is not without cost, if every telephone line draws current in the quiescent state, such current draw must be minimised.

Accordingly, the present invention seeks to provide power supply circuits and interrupt monitoring circuits which have minimal current draw in the quiescent state but which

are capable of providing higher power when required.

According to the present invention there is provided apparatus for connection to a communications line including a dc to dc converter connected to receive power from line terminals, the converter having a first lower power mode of operation and a second higher power mode of operation, the said converter powering a detector arranged for detecting the presence of a predetermined activation signal on the communications line characterised in that upon detection of such a signal the converter is switched from the first mode to the second mode to provide power to a second detector which checks the validity of the activiation signal prior to permitting the connection of power to other circuits.

Preferably the dc to dc converter includes an oscillator and a transformer, the oscillator being arranged to cause dc level switching to a primary winding of the transformer such that power transfer from the communications line to other circuits occurs, the change from the first mode of operation to the second mode being effected by causing an increase in the frequency of the oscillator.

An interrupt monitoring circuit including a power supply circuit in accordance with the invention will now be described by way of example only with reference to the accompanying drawings of which: -

Figure 1 is a block schematic diagram of a part of a telemetry monitoring apparatus;

Figure 2 is a circuit diagram of the oscillator of Figure 1;

Figure 3 is a circuit diagram of the DC-DC converter of Figure 1;

Figure 4 is a circuit diagram of the tone monitoring circuit of Figure 1; and

Figure 5 is a circuit diagram of the reset circuit of Figure 1.

Referring first to Figure 1, the telemetry monitoring apparatus uses a programmed microprocessor 1 to respond to signals received over a telephone line (A,B). Most

connections of the microprocessor 1 are not shown since they relate to functions which are not relevant to the present invention.

In the quiescent state, that is when no telemetry function is taking place, the microprocessor 1 remains in a low power standby mode pending receipt of an interrupt signal at input IRQ.

A tone detection circuit 4 monitors the telephone line A,B for a designated wake-up tone (or tones). Further detail of the operation of the line detection circuit may be found hereinafter.

The tone detection circuit 4 is supplied with power from a DC to DC conversion circuit 3 switching for which is provided by an oscillator circuit 2. All power for the circuit 3 is drawn from the telephone line A,B by way of a bridge rectifier circuit comprising diodes D11 - D14. The bridge circuit ensures that regardless of the polarity of the telephone exchange voltage on the A and B legs of the telephone line plus fifty volt and zero volt lines are consistent. The Diodes D11-D14 may be of type IN4003.

A ten ohm resistor R1 prevents excess current being drawn from the telephone line in the event of a short circuit occurring.

Referring also to Figure 2, a ten henry inductance T1 prevents tones on the A and B legs being sunk by the oscillator which comprises an operational amplifier, IC4, with both positive and negative feedback loops which vary the frequency of output square wave. Once the oscillator circuit 4 is running, an 8 volt line is provided from the DC-DC convertor 3. However, in order to start the power supply on first connection the eight volt line is linked by a 47 k ohm resistor R12 and a 39V zener diode D15 (type BZX8-539V) to the fifty volt line. When the eight volt line is supplied from the DC-DC converter 3 as hereinafter described, the diode D15 thus limits current drawn direct from the plus 50 volt supply.

The feedback loop of the Operational Amplifier IC4 (which may be a MAX409BCPA manufactured by Maxim) comprises a ten megohm resistor R23 linked to the positive input which together with a further 10 megohm resistor R24 form a divider which causes the positive input of IC4 to follow the square wave output. The negative input of IC4 is linked to the output by way of resistors R15 and R16 respectively of one megohm and thirty three megohms. Capacitor C8 (ten microfarad) allows the negative input to follow, charging from the voltage divider chain formed from resistors R13, R14 each of 10 Megohm value between the +8 volt and zero volt lines.

Still considering the quiescent state and referring also to Figure 3, the square wave output of the oscillator 2 is fed by way of capacitors C3, C4 each of 680 picofarad value to switches Q2 and Q3. As the capacitor C3 is tied to the +50 volt line by a 220K ohm resistor R10 and the capacitor C4 to the zero volt line by corresponding resistor R11 the output square wave (which was running at approximately 200 Hz) becomes a series of positive and negative spikes of 100 micro second duration. Since capacitor C11 (of 1 nanofarad) does not have time to charge the output at the junction of the switches Q2 and Q3 switches between zero and 50 volts.

Thus a transformer T2 which has one thousand turn primary winding and three secondary windings each of one hundred and sixty six turns is caused to transfer power. Although the input is spicate, ringing through the transformer will spread the transfer. A 100 nanofarad decoupling capacitor C34 is provided to the plus 50 V line.

The first secondary winding feeds a full-wave rectifier bridge circuit comprising four diodes D7, D8 and D40, D41 which may be type BAX13 although a half-wave rectifier may be used. A capacitor C14 (ten microfarads) smooths the output which provides a normal 8 volt supply to the oscillator 2. As previously described, the eight volt line biases the diode D15 (fig 2) thus causing power for the

oscillator to be drawn via the transformer T2 directly from the telephone line A, B.

The other two windings for the transformer T2 effectively provide a centre-tapped five volt power supply. A half-wave rectifier circuit comprising diodes D9 and D10 provides plus 2.5 V, Ground and -2.5 V lines. While the diodes D9 and D10 are type BAX13, Diodes D26 and D23 are of the zener type BZX2V7 to limit the output voltage. Capacitors C12 and C13 provide smoothing of the output which supplies power to the microprocessor 1 and tone detector 4 in the quiescent state drawing approximately five microamps from the line AB. For higher power applications it will be realized that a full-wave rectifier bridge may be incorporated.

Referring now to Figures 1 and 4, the tone detection circuit 4 comprises an automatic gain control (AGC) circuit 6, a band-pass filter 7 and a signal level detector 8.

Incoming tone signals are transferred from the 50 volt live side to the low voltage circuitry by a one to one transformer T3. Such tone signals pass to the negative input of an operational amplifier IC11 (which may be of type MAX409BCPA), the signals being biased by a one megohm resistor R2 connected to ground and a one hundred k ohm resistor R3. A 470 nanofarad capacitor C31 completes the circuit to the -2.5 volt line while preventing dc flow through R2.

Gain control is provided by a feed back loop comprising 100 k ohm resistor R4 and a one megohm resistor R5 across which diodes D5, D6 (type BAX13) are provided. The diodes D5, D6 will breakdown logarithmical if the output of the operational amplifier IC11 exceeds approximately 0.5 volts. By passing the resistor R5 thus increases the feedback bias on the negative input of the operational amplifier IC11 thus counteracting any high level output by reducing amplification of the output feed.

The gain controlled signal now passes by way of a 1 megohm resistor R27 to the band pass filter 7 and more

particularly to the negative input of the op amp IC12 which again may be of type MAX 409BCPA). The filter comprising capacitors C15, C16 and resistors R28, R29 feed back to the input of IC12 and prevent all except a narrow band of signals around the selected wake-up tone frequency being amplified and passed to the signal level detector 8.

In a specific example if the selected frequency (f_0) is 493 Hz, C15 may be ten picofarad, C16 one microfarad and R28 and R29 each of one hundred k ohm.

Appropriate to f_0 signals pass by way of a 100 nanofarad capacitor C17 to the positive input of an op amp IC13. Biasing of the input by one megohm resistor R31 connected to the ground line and ten megohm resistor R33 connected to the -2.5 volt line to ensure that low level (or accidental) signals do not pass. A small positive feedback by resistor R33 (ten megohms) and R32 (2.2 megohms) provides some hysteresis to the circuit.

An output line IRQ is normally biased to +2.5 volts by a ten megohm resistor R35. As the op amp IC13 converts an incoming high level tone to a square wave, diode D18 is forward biased causing a falling edge to provide an interrupt signal to the microprocessor 1.

Referring again to Figure 1, the microprocessor 1 is arranged, on interrupt, to cause its output PBO to go negative. This causes resistor R18 (Figure 2) to draw current by way of a photon coupled bilateral field-effect transistor IC5 and resistor R17 thus reducing the resistor feedback to the oscillator since IC5 now provides an approximate two hundred ohm bypass of the resistor R16. Capacitor C8 and resistor chain R15, R16 causes the oscillator output to approach a saw-tooth form. The positive input of the op amp IC4 follows a low level square wave provided by the resistors R23, R24 forming a divider and the much faster rise time thus provided causes an increase in the frequency of the oscillator 2. This increases the power transferred by the transformer (T2 of Figure 3) temporarily increasing the power drawn from the telephone line A, B.

This temporary increase in power available allows the microprocessor IC15 to carry out an accurate frequency check (approximately plus or minus one Hz) on the tone signal output from IC13 to an input TCAP of the microprocessor. If the tone is no longer present or is not of the required value, the PBO output is returned to normal and the microprocessor returns to the quiescent state pending receipt of a further interrupt via IRQ.

If the signal received is a valid "wake-up" signal another output (not shown) is used to cause a voltage supply rail for other circuits (also not shown) to be connected to the -2.5 volt supply by a transistor switch.

It is here noted that if power demand is maintained, the frequency of the oscillator 2 will increase as capacitor C7 discharges such that the input to the transformer T2 approaches a high frequency square wave - having a period which approaches the duration of the spike output of the oscillator in the quiescent state.

For first connection or reconnection or in case the occurrence of low or zero voltage for other reasons may have caused the microprocessor 1 to enter an untenable state, a reset circuit 5 (Figure 1) is responsive to rising voltage to provide a reset signal. The reset signal (received at input R15) will cause the microprocessor 1 to "re-boot" in known manner.

Thus referring to Figure 5, an operational amplifier IC7 is normally held switched off by biassing provided by resistors R37 (10 megohm) R73 (5.6 megohm) and R36 (4.7 megohm). As the + and - 2.5V line voltages increase from zero, diode D25 conducts causing a change in the voltage on the positive input pending re charging of capacitor C37. This causes the output of IC7 to change which change shows as a voltage edge passing through C1A causing the R/S bias (provided by way of a 10 megohm resistor R41) to change. This provides the reset signal to the microprocessor 1.

It will be appreciated that the single tone detection circuit comprises of the filter 7 and level detector 8 may be

modified to detect dual or multiple tone activation signals. Thus, for example, for DTMF type signalling a second appropriately tuned filter may be added at the output of the AGC circuit 6.

While as herein described zener diodes have been used equivalent components of the type known as silicon stabilizer diodes may be used in place thereof. The use of silicon stabilized diodes in place of zener diodes has been shown to decrease the power consumption of the circuit.

CLAIMS

1. Apparatus for connection to a communications line including a dc to dc converter connected to receive power from line terminals, the converter having a first lower power mode of operation and a second higher power mode of operation, the said converter powering a detector arranged for detecting the presence of a predetermined activation signal on the communications line characterised in that upon detection of such a signal the converter is switched from the first mode to the second mode to provide power to a second detector which checks the validity of the activiation signal prior to permitting the connection of power to other circuits.

2. Apparatus for connection to a communications line as claimed in claim 1 further characterised in that the dc to dc converter includes an oscillator and a transformer, the oscillator being arranged to cause dc level switching to a primary winding of the transformer such that power transfer from the communications line to other circuits occurs, the change from the first mode of operation to the second mode being effected by causing an increase in the frequency of the oscillator.

3. Apparatus for connection to a communications line as claimed in claim 2 further characterised in that in the first mode the output of the oscillator is a series of positive and negative voltage spikes and in the second mode approaches a square wave.

4. Apparatus for connection to a communications line as claimed in claim 2 or claim 3 further characterised in that the transformer has a plurality of secondary windings, a first of which provides output power to drive the oscillator and a second of which provides output power for the detector and other circuits.

5. Apparatus for connection to a communications line as claimed in claim 4 further characterised in that output power for the detector is drawn from a balanced pair of secondary windings.

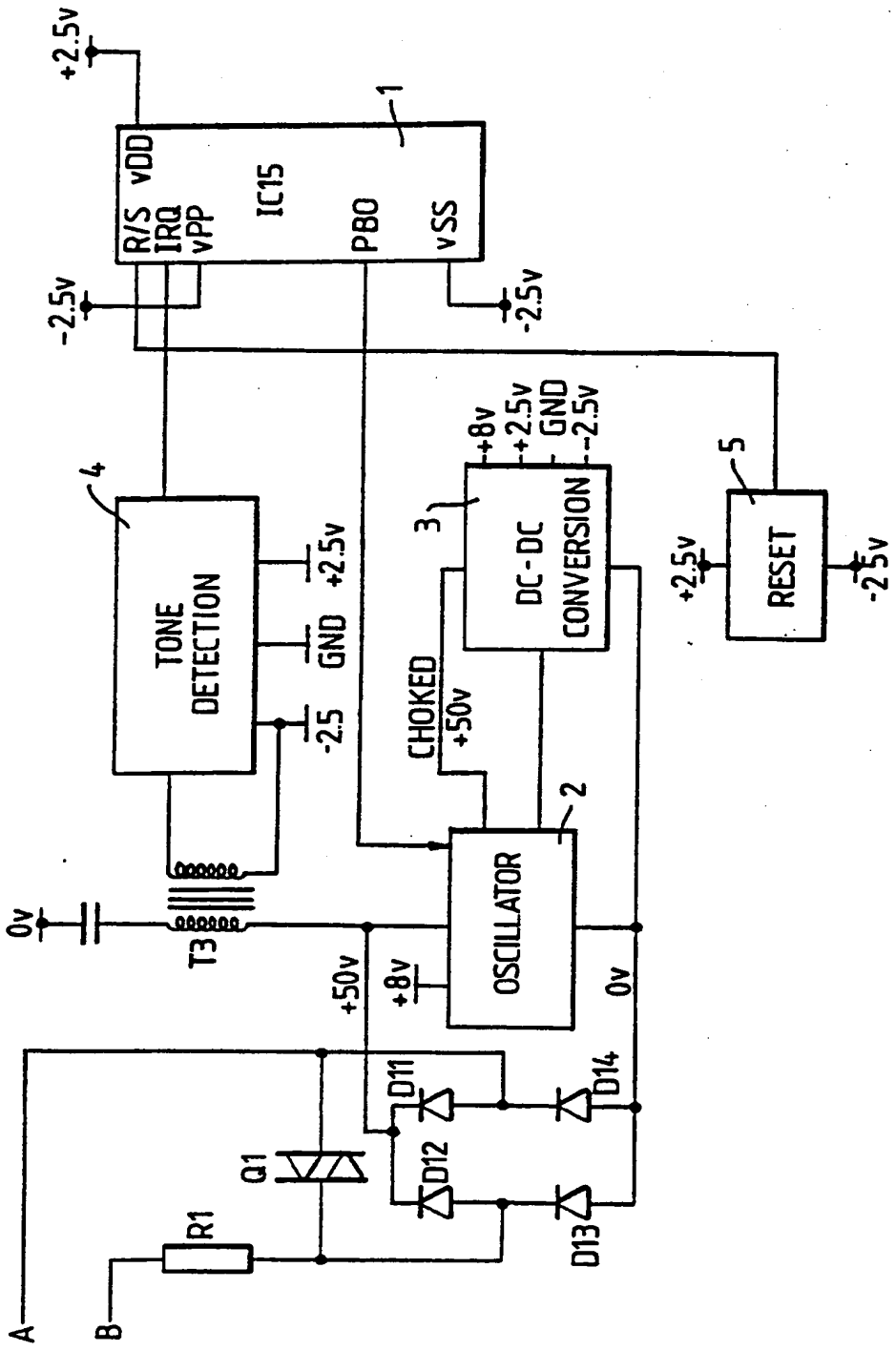
6. Apparatus for connection to a communications line as claimed in any preceding claim further characterised in that the detector comprises gain control means, a band pass filter and a signal level detector, the signal level detector providing an output signal on detection of the predetermined activation signal to cause an interrupt to be provided to a processor circuit.

7. Apparatus for connection to a communications line as claimed in claim 6 when dependent on claim 2 further characterised in that on receipt of an interrupt the processor circuit causes an increase in the frequency of the oscillator.

8. Apparatus for connection to a communications line as claimed in claim 6 or claim 7, further characterised in that the detector comprises a plurality of band pass filters whereby an activation signal comprising a plurality of multi-frequency tones may be detected.

9. Apparatus for connection to a communication line as claimed in any preceding claim further characterised in that means are provided responsive to increasing power supply voltage to provide an output signal at a predetermined voltage level such that circuits which may be adversely affected by low voltage conditions are reset.

Fig.1.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1
vDD
R/S
IRQ
vPP
IC15
PBO
vSS
-2.5v
-2.5v
+8v
+2.5v
GND
-2.5v
3
DC-DC CONVERSION
4
TONE DETECTION
+2.5v
GND
-2.5
CHOKED
+50v
5
RESET
+2.5v
-2.5v
0v
T3
2
OSCILLATOR
+50v
+8v
0v
D11
D14
Q1
D12
D13
R1
A
B

Fig.2.

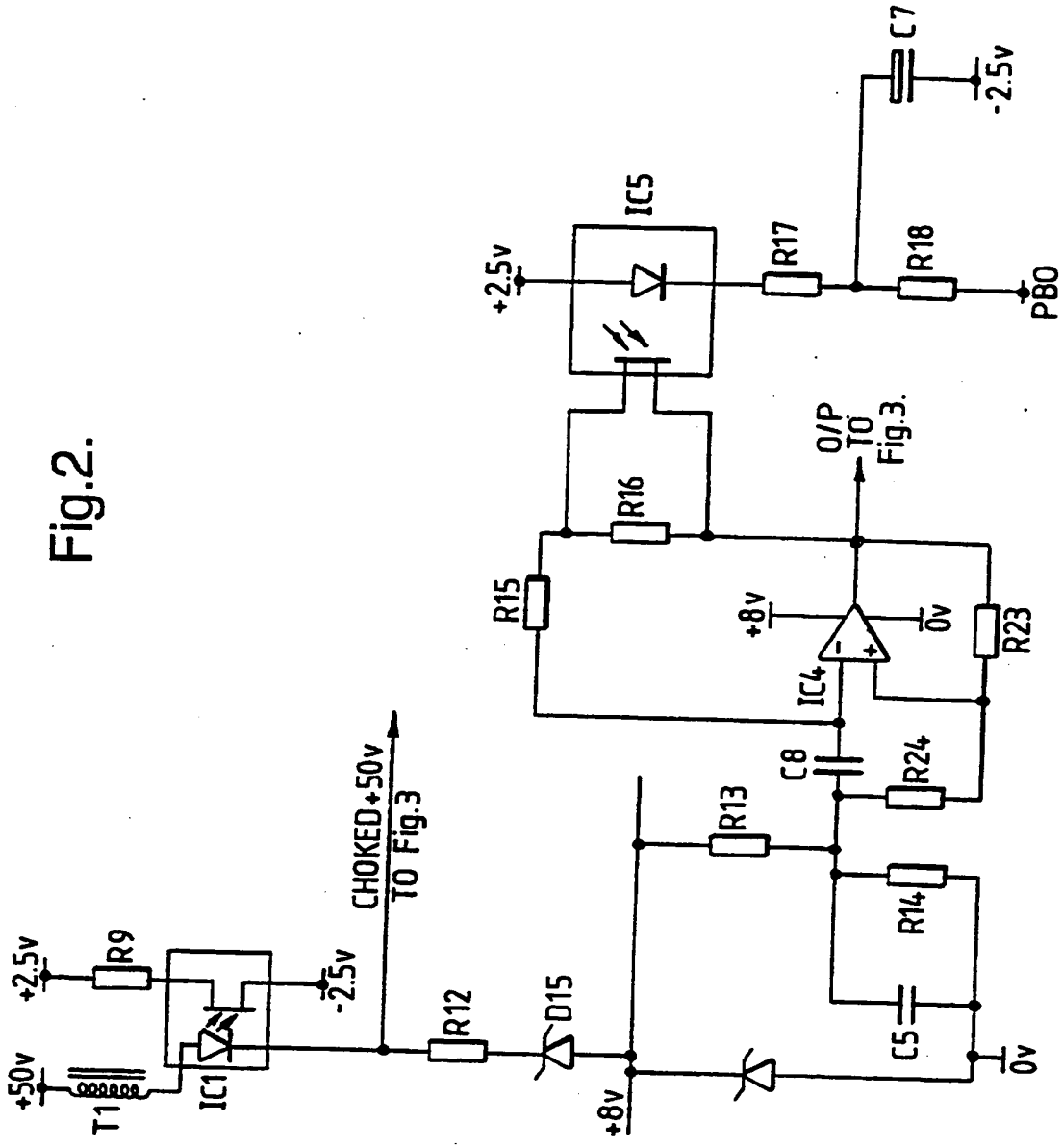
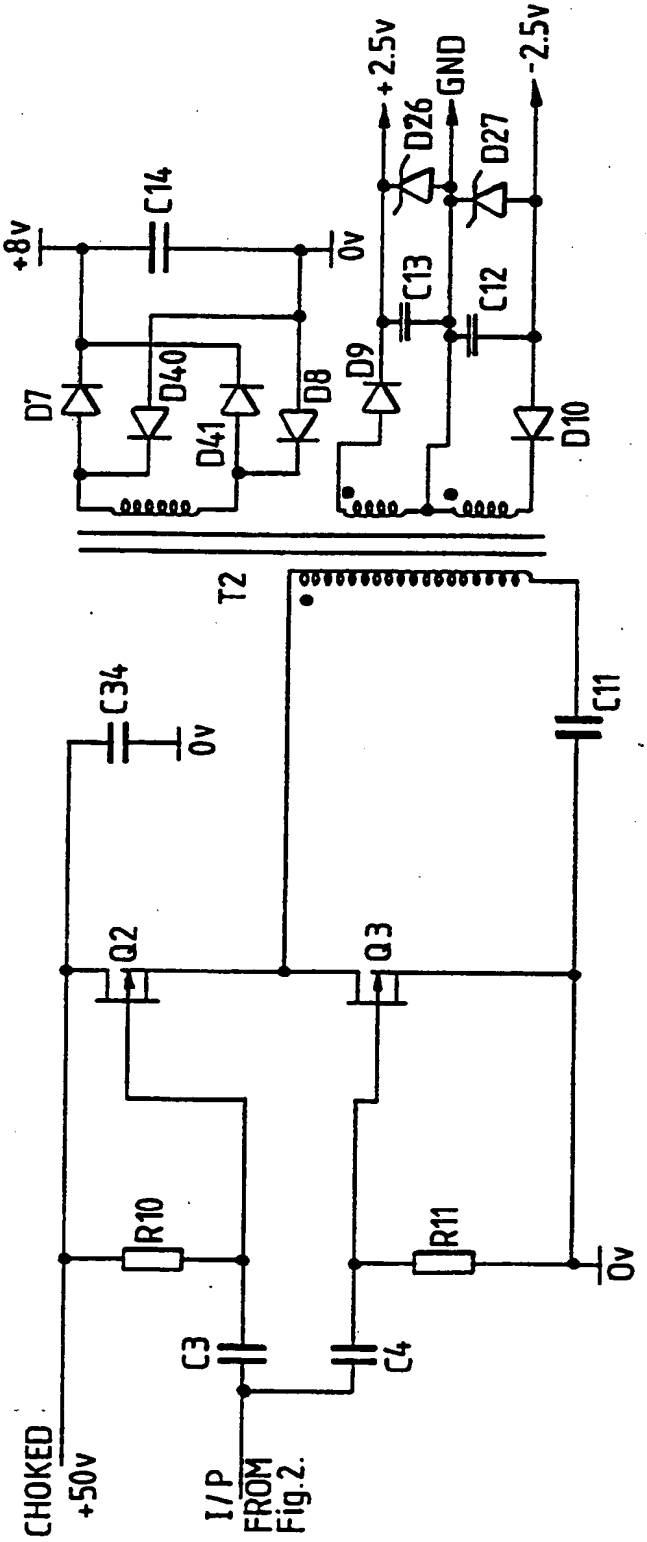

C7
-2.5v
IC5
+2.5v
R17
R18
PBO
O/P TO Fig.3.
R16
R15
+8v
0v
R23
IC4
C8
R24
R13
R14
C5
0v
CHOKED+50v TO Fig.3
+2.5v
R9
-2.5v
R12
D15
+50v
T1
IC1
+8v

Fig.3.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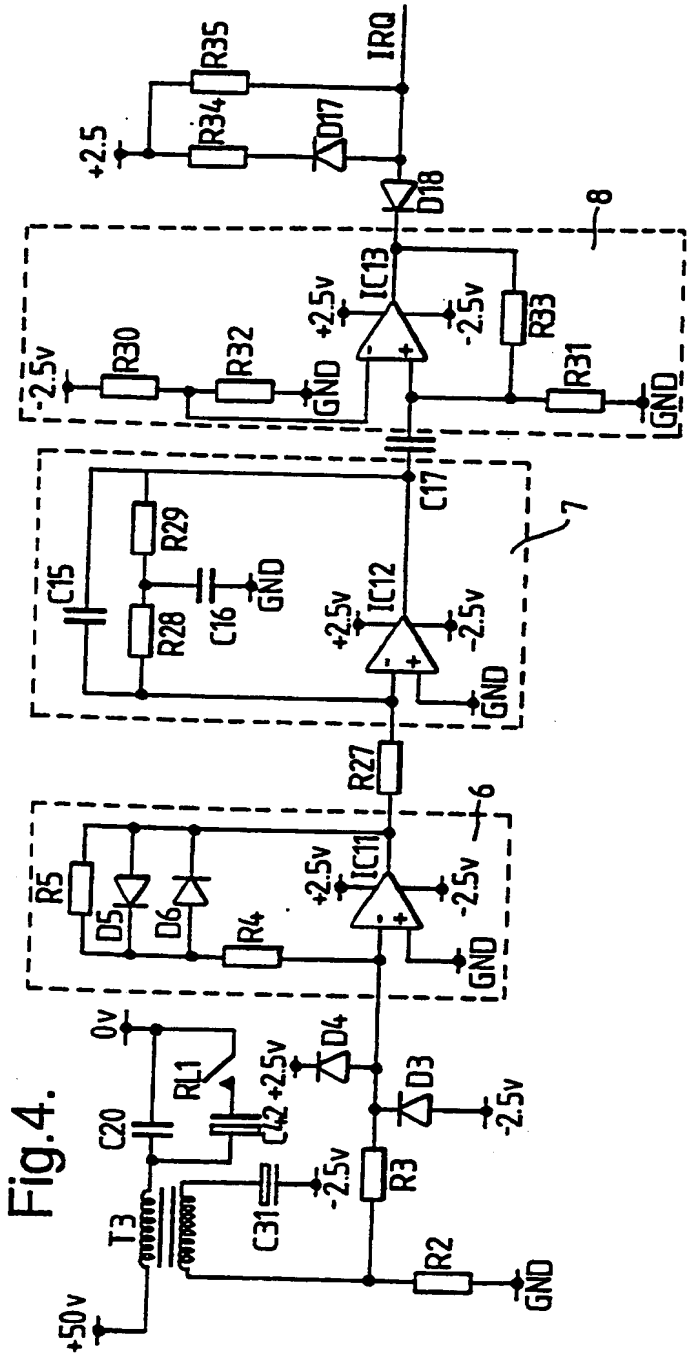
GND
-2.5v
D26
D27
C14
+8v
0v
C13
C12
D7
D40
D8
D9
D41
D10
T2
C34
0v
C11
Q2
Q3
R10
R11
0v
C3
C4
CHOKED
+50v
I/P
FROM
Fig.2.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0v
T3
C20
RL1
C42
C31
+2.5v
-2.5v
D4
D3
R3
R2
GND
R5
D5
D6
R4
IC11
6
R27
C15
R29
R28
C16
IC12
C17
7
R30
R32
IC13
R33
R31
8
+2.5
R35
R34
D17
IRQ
D18

Fig.4.

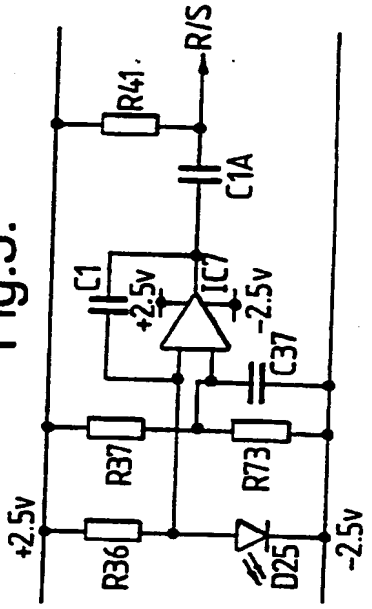
R/S
R41
C1A
C1
IC7
C37
R37
R73
R36
D25
+2.5v
-2.5v

Fig.5.

INTERNATIONAL SEARCH REPORT

Interna' ıl Application No
PCT/GB 95/00855

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04M19/08 H04M11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04M H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	US-A-5 204 896 (OLIVER) 20 April 1993 see column 7, line 51 - line 56	1 2-9
Y	WO,A,89 11194 (CANADIAN COMMUNICATIONS INNOVATIONS INC) 16 November 1989 see page 4, line 21 - line 30	1
A	PATENT ABSTRACTS OF JAPAN vol. 13 no. 88 (E-721) ,28 February 1989 & JP,A,63 266956 (NEC CORP.)	1-9
A	EP-A-0 214 915 (INTERNATIONAL STANDARD ELECTRIC CORPORATION) 18 March 1987 see figures 6,8	1-9

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 July 1995	19. 07. 95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Montalbano, F

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INTERNATIONAL SEARCH REPORT

Interna' al Application No
PCT/GB 95/00855

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 15 no. 98 (E-1042) & JP,A,02 306754 (NIPPON TELEGRAPH & TELEPHONES CORP.) 20 December 1990, see abstract	1-9
A	IEEE JOURNAL OF SOLID-STATE CIRCUITS, vol. 26, no. 7, July 1991 NEW YORK US, pages 1027-1032, XP 000237045 R. BECKER ET AL. 'SIGFRED: A low-power DTMF and Signaling frequency detector 237045'	6,8

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Interna al Application No
PCT/GB 95/00855

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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WO-A-8911194	16-11-89	AU-A-	3567189	29-11-89
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		AU-B-	588907	28-09-89
		AU-A-	6210686	12-03-87
		JP-C-	1696505	28-09-92
		JP-B-	3059620	11-09-91
		JP-A-	62065550	24-03-87